

# The epidemiology of pediatric trauma in the emergency department of a trauma center: An observational study

The epidemiology of pediatric trauma

Nurgül Akça<sup>1</sup>, Ömer Faruk Demir<sup>2</sup>, Secdeğül Coşkun Yaş<sup>3</sup>

<sup>1</sup> Department of Emergency Medicine, Karabük University, Karabük Training and Research Hospital, Karabük

<sup>2</sup> Department of Emergency Medicine, University of Health Sciences, Diskapı Yıldırım Beyazıt Training and Research Hospital, Ankara

<sup>3</sup> Department of Emergency Medicine, University of Health Sciences, Ankara Training and Research Hospital, Ankara, Turkey

## Abstract

**Aim:** This study aimed to comprehensively analyze the epidemiology of pediatric trauma in the emergency department of a designated trauma center. The study focused on demographic factors, injury mechanisms, and outcomes, with the ultimate goal of informing preventive measures.

**Material and Methods:** This retrospective observational study was conducted over a one-year period. The study included pediatric trauma patients under 18 years of age admitted to the emergency department of a tertiary care hospital. Data, encompassing patient demographics, time of presentation, injury mechanisms, laboratory and radiologic examinations, consultations, procedures, and outcomes, were analyzed.

**Results:** Of the 434,000 patients admitted during the study year, 30,710 were pediatric trauma cases. The majority were males (64.3%) with a mean age of 10.09 years. Simple falls were the predominant mechanism (90.6%), and the 11-15 age group had the highest number of admissions. Injury patterns varied across age groups, with gender differences observed. Most admissions occurred between 16:00-00:00, and Orthopedics received the highest consultation requests. Ninety-nine percent were discharged, 0.9% were hospitalized, and one patient died. Surgical intervention was required in 97% of hospitalized cases.

**Discussion:** The findings of this observational study on pediatric trauma epidemiology in a trauma center's emergency department contribute valuable insights to the existing literature. The study analyzed a significant number of patients and revealed that male children experienced trauma more frequently. The most common causes of trauma were simple falls and road traffic accidents.

## Keywords

Pediatric, Emergency Medicine, Injuries, Trauma Center

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Corresponding Author: Ömer Faruk Demir, Department of Emergency Medicine, University of Health Sciences, Diskapı Yıldırım Beyazıt Training and Research Hospital, Ankara, Turkey.

E-mail: demirof@yahoo.com P: +90 530 665 08 02

Corresponding Author ORCID ID: <https://orcid.org/0000-0002-2416-0274>

This study was approved by the Ethics Committee of University of Health Sciences Diskapı Yıldırım Beyazıt Training and Research Hospital (Date: 2020-07-20, No: 92/14)

## Introduction

Trauma and trauma-related health problems are among the world's leading health problems. Trauma is the leading cause of death, particularly in childhood and young adulthood [1]. The lifetime costs of trauma-related injuries are also quite high [2]. In addition to being a major cause of mortality, childhood injuries are known to result in lifelong morbidity [3]. Most importantly, these injuries have many preventable causes [4]. The management of pediatric trauma is similar to that of adult patients, but there are several anatomical, physiological, and psychological differences [3]. Therefore, different approaches are used in the evaluation of pediatric trauma patients. Data on the epidemiology and etiology of pediatric trauma patients will guide the management of this patient population. There are studies in the literature on this subject, but it is not possible to generalize the results to all countries and to all environmental conditions [5].

The aim of this study was to make a demographic analysis of pediatric patients presenting with all types of physical trauma and injury, to determine the etiology of trauma and injury, and to create a resource for the development of preventive factors.

## Material and Methods

This is a retrospective observational study. It was conducted in a tertiary care hospital, defined as a trauma center.

The study included trauma patients under 18 years of age who were admitted to the Emergency Department of Diskapi Yildirim Beyazit Training and Research Hospital during a one-year period between January 2019 and January 2020. Patients who were over 18 years of age or non-trauma pediatric patients were excluded from the study. The Emergency Department where the study was conducted served both adult and pediatric trauma patients.

The study analyzed various factors including age, gender, time and date of presentation, laboratory and radiologic examinations, consultations, procedures performed in the emergency department, need for surgery, and outcomes. The mechanism of injury was analyzed in ten different subgroups (simple fall, road traffic accident, fall from height, physical assault, stab-cut injuries, gunshot injury, burns, foreign body, animal bite, and occupational accidents). The data were obtained from patient files and the electronic medical record system.

The statistical analysis was performed using SPSS version 20 (IBM Corporation, Armonk, NY). Descriptive statistics were reported as mean  $\pm$  standard deviation (SD) for continuous variables, and as percentiles and rates for categorical variables. The normality of the continuous variables was evaluated using the Kolmogorov-Smirnov test. The categorical variables were compared using Pearson's  $\chi^2$  test. A p-value less than 0.05 was considered statistically significant.

## Ethical Approval

This study was approved by the Ethics Committee of University of Health Sciences Diskapi Yildirim Beyazit Training and Research Hospital (Date: 2020-07-20, No: 92/14).

## Results

Out of the 434,000 patients admitted to the emergency

department during the study year, 30,710 were pediatric trauma patients. Of these patients, 19,743 (64.3%) were male, and the mean age was  $10.09 \pm 5.14$  years. The highest number of admissions was found in the 11-15 age group, with 9,845 (32.1%) patients, according to the analysis of patient distribution by age groups (Figure 1). The most common mechanism of injury was simple falls with 27,817 (90.6%) patients. This was followed by road traffic accidents and physical assaults, respectively (Table 1). Upon analyzing the relationship between injury mechanisms and gender, it was found that all mechanisms were significantly more common in men ( $p < 0.001$ ).

Children aged 11-15 years experienced more simple falls, while children aged 6-10 years experienced more road traffic accidents than other age groups. Children aged 1-5 years had a higher incidence of admission due to falls from height, burns, and foreign bodies. Children aged 16 years and older had a higher incidence of admission due to physical assault, stab-cut injuries, gunshot injuries, animal bites, and occupational injuries. There was a significant difference in the mechanism of injury among the four age groups ( $p < 0.001$ ). Table 2 provides detailed information on the age groups and mechanisms of injury.

When analyzing patient admissions by time period, 17,517 (57%) of the admissions occurred between 16:00-00:00, 11,230

**Table 1.** Patient characteristics, mechanism of injury, and outcomes

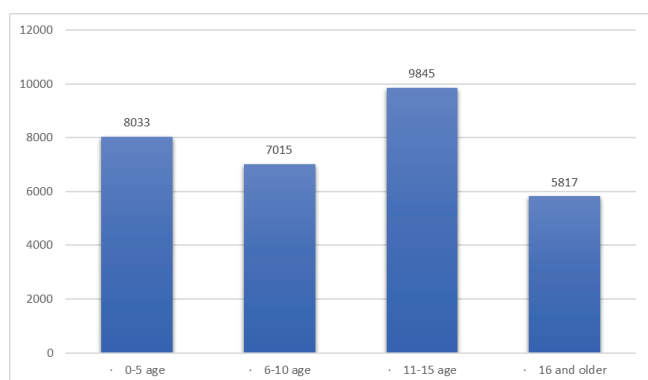
	Total
	n = 30,710
Male gender, n (%)	19,743 (64.3)
Age, median $\pm$ SD	10,09 $\pm$ 5,14
Mechanism of injury, n (%)	
· Simple fall	27,817 (90.6)
· Road traffic accidents	1113 (3.6)
· Physical assault	605 (2)
· Foreign bodies	417 (1.4)
· Fall from height	405 (1.3)
· Stab-cut injuries	253 (0.8)
· Burns	40 (0.1)
· Occupational accidents	31 (0.1)
· Animal bites	17 (0.05)
· Gunshot injury	12 (0.04)
Patients undergoing surgery	265 (0.9%)
Outcome, n (%)	
· Discharge from ED	30,389 (99)
· Admitted to hospital	273 (0.9)
· Death in the ED	1 (0.0)
· Referral to another hospital	47 (0.2)
Hospitalization department, n (%)	
· Orthopedics	201 (73.6)
· Neurosurgery	26 (9.5)
· Otolaryngology	23 (8.4)
· Plastic and Reconstructive Surgery	18 (6.6)
· Intensive care unit	2 (0.7)
· Urology	1 (0.4)
· Ophthalmology	1 (0.4)
· Cardiovascular surgery	1 (0.4)

**Table 2.** Mechanism of injury among different age groups

Mechanism of injury, n (%)	0-5 age	6-10 age	11-15 age	16 and older	Total
Simple fall	7369 (26.5)	6324 (22.7)	9109 (32.7)	5015 (18)	27,817 (100)
Road traffic accidents	169 (15.2)	362 (32.5)	347 (31.2)	235 (21.1)	1113 (100)
Physical assault	21 (3.5)	56 (9.3)	187 (30.9)	341 (56.4)	605 (100)
Foreign bodies	254 (60.9)	108 (25.9)	37 (8.9)	18 (4.3)	417 (100)
Fall from height	174 (43)	105 (25.9)	86 (21.2)	40 (9.9)	405 (100)
Stab-cut injuries	25 (9.9)	52 (20.6)	58 (22.9)	118 (46.6)	253 (100)
Burns	20 (50)	7 (17.5)	8 (20)	5 (12.5)	40 (100)
Occupational accidents	0	0	5 (16.1)	26 (83.9)	31 (100)
Animal bites	0	1 (5.9)	3 (17.6)	13 (76.5)	17 (100)
Gunshot injury	0	0	5 (41.7)	7 (58.3)	12 (100)

**Table 3.** Departments where patients are consulted, medical procedures performed on patients and laboratory tests and radiological examination requested by patients

Number (percentage in all patients)	
Total n = 30,710	
<b>Consultant Department</b>	
Orthopedics	9579 (31.2%)
Otolaryngology	1433 (4.7%)
Neurosurgery	814 (2.7%)
Plastic and Reconstructive Surgery	635 (2.1%)
Pediatric surgery	296 (1%)
Pediatrics	103 (0.3%)
Urology	43 (0.1%)
Infection diseases	37 (0.1%)
Ophthalmology	23 (0.1)
<b>Medical procedures in emergency department</b>	
Closed reduction	4118 (13.4%)
Suturation and dressing	3586 (8.4%)
Only wound dressing	2364 (7.7%)
Foreign body removal	417 (1.3%)
Splint	400 (1.3%)
Endotracheal intubation	5 (0.0%)
Blood transfusion	2 (0.0%)
<b>Radiological examination / laboratory tests</b>	
Radiography	23,171 (75.5%)
Computed tomography	3497 (11.4%)
Hemogram	1874 (6.1%)
Biochemical tests	1747 (5.7%)
Ultrasound	1374 (4.5%)



**Figure 1.** The distribution of the patients according to the age groups

(36.6%) between 08:00-16:00, and 1963 (6.4%) between 00:00-08:00.

Consultation was requested from other departments for 39.4% of the patients. The Orthopedics department had the highest number of consultations with 9576 (31.2%) patients. Some patients consulted more than one department. Table 3 shows the other departments for which consultation was requested.

Out of all the patients, 30,389 (99%) were discharged from the emergency department and 273 (0.9%) were admitted to the hospital. One patient died in the emergency department. This patient was admitted due to a road traffic accident. In the study, 97% (265) of the hospitalized patients underwent surgical treatment. The majority (73.6%) of the hospitalized patients were admitted to the orthopedic department (Table 1). Medical procedures performed in the emergency department and diagnostic tests requested were analyzed. It was found that 81.2% of children admitted to the emergency department had at least one diagnostic test requested, whereas 18.8% of children admitted to the emergency department had no diagnostic test requested. Reduction and suturation were the most common procedures performed. Direct radiography was the most frequently requested diagnostic test, accounting for 75.5% of cases (Table 3).

**Discussion**

In our observational study of pediatric trauma patients, injury mechanisms and demographic characteristics of 30,710 patients were analyzed. Our findings were largely consistent with existing literature.

In their study analyzing ambulance system data on pediatric traumas, Wohlgenut et al. found that the mean age was 9 years [6]. Tambay et al. found that the majority of pediatric trauma patients admitted to the emergency department were in the 7-14 age group [7]. Demir et al. conducted a study on pediatric patients admitted for forensic reasons, the majority of whom were trauma patients, and found that the mean age was 8.8 years [8]. In our study, we found that the mean age of the patients was 10 years, and the most common age group was 11-15 years.

In our study, 64.3% of the patients were male. Consistent with our results, previous studies have also reported a higher incidence of males presenting with pediatric trauma. Oliver et al reported that 68.3% of their patients were male [9]. In their

study conducted in Norway, Nesje et al. found that 61% of the patients were male [10]. Although there is no definite proven reason between the frequency of trauma and gender, trauma admissions are more common in boys. Boys may engage in more risky behaviors during physical games and act more impulsively, which could be a reason for this.

Demir et al. reported that 57% of the cases occurred between 16:00-00:00 [8]. Similarly, Jalalvandi et al. found that accidents were most frequently observed during the hours of 18:00-00:00 [11]. In our study, we also found that 57% of admissions were between 16:00-00:00 when analyzed in three groups based on hours.

The study revealed that the most frequent mechanism of injury for pediatric trauma patients was simple falls, followed by road traffic accidents. This finding is consistent with a study conducted by Herbert et al in South Africa, where falls (39%) and traffic accidents (15%) were also the most common mechanisms of presentation [12]. Similarly, a study conducted in Iran found that falls accounted for 65% of trauma mechanisms, while road traffic accidents accounted for 16% [11]. A study conducted in the UK, including moderate and severe pediatric trauma, found that 40.9% of patients presented with road traffic accidents and 36.9% with falls [13]. Similarly, a study conducted in Norway that included all pediatric traumas found that the most common mechanism of trauma was road traffic accidents, accounting for 61%, followed by falls at 21% [10]. In our study, the rate of simple falls was 90.6%. This high rate may be attributed to the large number of patients and the variation in the frequency of local emergency department visits. It is known that 95% of pediatric trauma deaths occur in low- and middle-income countries [14]. The geographical and socioeconomic structure of the region is a significant factor in the epidemiology of trauma mechanisms. For instance, our population did not experience any cases of drowning within a year, despite it being a significant cause of traumatic deaths in children according to the literature [4].

When analyzing injury mechanisms by age, patients aged 16 years and older had higher rates of physical assault, stab-cut injuries, occupational accidents, and gunshot injuries. It was anticipated that these mechanisms would be more prevalent among adolescents. Additionally, foreign bodies, falls from height, and burn mechanisms were found to be more common in the 0-5 age group. Previous studies have indicated that injuries occurring at home are more frequent in this age group [11]. To prevent these types of injuries, caregivers should receive education on how to enhance safety measures in domestic environments.

In the study, the majority of pediatric trauma patients were associated with the orthopedic department. Most consultations and hospital admissions were to the orthopedic department. Jajalvaldi et al. reported that pediatric trauma patients had mostly orthopedic injuries [11]. Additionally, many studies investigating pediatric trauma have found that extremity injuries are among the most frequent [12, 15]. As our study was retrospective, we were unable to access all data, and therefore, detailed diagnoses could not be included in the study. However, the fact that the most common medical procedure performed was reduction and the most common consultation was with

orthopedics shows that extremity fractures and dislocations are common in our patient population.

The study showed that the number of patients admitted in one year was considerably high. Of these, 99% were discharged, 67.7% did not require medical procedures, and 18.8% did not require diagnostic tests. These findings suggest that many admissions could be resolved with simple treatments. In addition to addressing preventable causes of pediatric trauma, it is important to discuss ways to prevent unnecessary emergency department visits.

#### **Limitation**

The study's most significant limitation was its single-center design, as the subject of the research is highly influenced by environmental and sociocultural factors. However, the analysis of regional data also provides important contributions in this area. Since the study was planned retrospectively, it was not possible to detail the data as much as desired. Examining the patients' diagnoses in addition to the mechanisms of injury, would have provided more valuable results. Furthermore, the unavailability of trauma scoring systems prevented the determination of the patients' severity.

#### **Conclusion**

Our epidemiologic study, which should be evaluated in the context of its own environmental factors, provided important findings about the general reasons for the presentation and outcomes of pediatric trauma patients. The study, which included a large number of patients, found that male children were more frequently exposed to trauma and that the most common mechanisms of trauma were simple falls and road traffic accidents. Considering the diagnostic tests and consultations required for this group of patients, a significant need for resources was observed. Necessary precautions should be taken to prevent pediatric injuries with the data obtained. As a vital contribution to the field, this study provides a foundation for further research and the development of evidence-based interventions to minimize the impact of pediatric trauma on healthcare systems and, more importantly, on the well-being of the affected children.

#### **Scientific Responsibility Statement**

*The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.*

#### **Animal and Human Rights Statement**

*All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.*

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#### **Conflict of Interest**

*The authors declare that there is no conflict of interest.*

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